

SUBSTITUTE SPECIFICATION
U.S. Patent Application Serial No. 08/968,034

What is claimed is:

1-7. (Cancelled)

8. An apparatus for mixing batches of a liquid and a powder component for preparation of bone cement, comprising:

a mixing vessel pre-filled with the powder component of the bone cement, said vessel defined by an outer wall having a top end, a bottom end and an interior, said top end formed with a sealable spout, said bottom end formed with an axially displaceable bottom;

a vacuum source connected to the interior of said mixing vessel for maintaining the interior of said mixing vessel under vacuum;

an agitator at least partially disposed within said vessel interior, said agitator comprising a tubular rod which extends upwardly out of said interior through said spout, and an agitator disk attached to said tubular rod and disposed within the interior, a first end of said tubular rod being open and defining a mouth, and a second end of said tubular rod being open and encircled by said disk, and said tubular rod is axially displaceable within said vessel interior;

a generally cylindrical container having a top, a bottom, and an interior;

a glass ampoule having a sealed interior and a tip, said sealed interior containing the liquid bone cement component, said ampoule received within said interior of said container; and

a cap secured to the top of said container, said cap having an opening therein whereby atmospheric air is communicated through said cap and into said interior of said container.

9. A method for preparing bone cement by mixing batches of a liquid and a powder bone cement component, the method comprising the steps of:

providing a mixing vessel that is maintained under vacuum and that contains a pre-determined amount of the powder bone cement component, said vessel comprising a cylinder having an open interior with a spout at one end of said cylinder and having an axially displaceable bottom;

providing a mixing agitator within said vessel interior, said agitator comprised of a tubular rod having an agitator disk fixed on one end thereof, an opposite end of said tubular rod being open and defining a mouth, said mouth being located axially above said spout of said vessel, said agitator being axially displaceable within the vessel interior such that said agitator disk can mix the bone cement components together;

providing a tightening rod within said tubular rod so as to seal said vessel from atmosphere before said liquid component is introduced into said vessel;

removing said tightening rod and then introducing said liquid component into said interior of said vessel;

re-inserting said sealing rod within said tubular rod, thereby sealing said vessel from atmosphere; and

axially displacing said agitator so as to mix said liquid and powder components under vacuum, without allowing harmful emissions to escape said mixing vessel.

10. The apparatus according to claim 8, wherein said interior of said container including means for breaking said ampoule when said cap pushes on said ampoule, thereby allowing said container to feed said liquid component into said vessel.

11. The method of claim 9 further comprising providing a container that contains said liquid component, and placing said container in said mouth of said tubular rod.

12-13. (Cancelled)

14. An apparatus for preparing bone cement from liquid and powder bone cement components, comprising:

a mixing vessel pre-filled with the powder component of said bone cement, said vessel defined by an outer wall having a top end, a bottom end and an interior, said top end formed with a sealable spout, said bottom end formed with an axially displaceable bottom;

a vacuum source connected to the interior of said mixing vessel for maintaining the interior of said mixing vessel under vacuum;

means for introducing said liquid component into said interior of said mixing vessel through said sealable spout; and

an agitator at least partially received within said vessel interior, said agitator comprised of a tubular rod which extends upwardly out of said interior through said spout and is in communication with the atmosphere and an agitator disk attached to said tubular rod, a first end of said tubular rod being open and defining a mouth and a second end of said tubular rod being open and encircled by said disk, said agitator disk is axially displaceable within said vessel interior for mixing said bone cement components.

15. The apparatus of claim 14 wherein said means for introducing said liquid component into said vessel is comprised of a container having an interior for containing said liquid component, a tip, and a tube connected to said tip, said tube connecting said container to said mixing vessel.

16. The apparatus of claim 15 wherein said tube is adapted to be inserted into said mouth of said tubular rod.

17-26. (Cancelled)

27. A method for introducing into a mixing vessel under partial vacuum a liquid component of bone cement to be mixed with a powder component of bone cement, the method comprising:

providing a container which has an open interior, a threadable cap and means for breaking a glass ampoule;

placing a glass ampoule containing said liquid component into said open interior;

turning said cap for pushing downwards on said ampoule for breaking it against said means for breaking; and

allowing said container to feed the liquid component through an opening in the container into said mixing vessel.

28. A method according to claim 27 further comprising connecting said container opening to the mixing vessel in an airtight manner, and allowing ambient air to enter into said open interior of the container through an opening in the cap of the container.

29. An apparatus for introducing into a mixing vessel under partial vacuum a liquid component of bone cement to be mixed with a powder component, wherein said apparatus comprises:

a container which has an open interior for receiving at least one glass ampoule containing said liquid component and a threadable cap for pushing downwards on said ampoule, said interior including means for breaking said ampoule when said cap pushes on said ampoule.

30. An apparatus according to claim 29 wherein the container includes an opening that is adapted to be connected in an air tight manner to the mixing vessel, and

wherein the cap has an opening for allowing ambient air to enter into said open interior of the container.

31. (Cancelled)

32. A method for feeding a liquid bone cement component into a mixing vessel maintained under vacuum for the preparation of bone cement wherein said mixing vessel is provided with a predetermined amount of a powder component of said cement, the method comprising the steps of:

providing a mixing vessel defined by a cylindrical container having an open interior with a spout attached to one end of said container, and having an axially displaceable bottom;

inserting a mixing agitator within said mixing vessel so as to communicate with said vessel interior, said agitator comprised of a tubular rod having an agitator disk fixed on one end thereof and having a second, open end defining a mouth, said mouth being located axially above said spout of said vessel, said agitator being axially displaceable such that said agitator disk can mix both of said bone cement components together;

placing a container in said mouth of said tubular rod, said container having an interior space for receiving a glass ampoule and a threadable cap for pushing downwards on said ampoule, said interior space including a means for breaking said ampoule when said cap pushes on said ampoule thereby allowing said container to feed liquid into said vessel; and

axially displacing said agitator so as to mix said liquid and powder components under vacuum, without allowing harmful emissions to escape said mixing vessel.

33-40. (Cancelled)

41. An apparatus for mixing a liquid and a powder component for the preparation of bone cement under vacuum in order to prevent harmful emissions from escaping once said liquid and powder components are mixed, comprising:

a mixing vessel defined by an outer wall having a top end, a bottom end and an interior, said top end formed with a sealable spout, said bottom end formed with an axially displaceable bottom, said mixing vessel containing the powder bone cement component;

means for introducing said liquid component into said interior of said mixing vessel through said sealable spout;

an agitator at least partially received within said vessel interior, said agitator comprised of a tubular rod which extends upwardly out of said interior through said spout and is in communication with the atmosphere and an agitator disk with holes attached to said tubular rod, a first end of said tubular rod being open and defining a mouth and a second end of said tubular rod being open and encircled by said disk, said tubular rod being axially displaceable within said vessel interior for mixing said bone cement components;

a removable tightening rod disposed within said tubular rod for sealing at least one open end thereof from communication with the atmosphere prior to and after said liquid component is introduced into said mixing vessel, said tightening rod being removed from said tubular rod immediately prior to introducing said liquid bone cement component into said mixing vessel and being reinserted therein after said liquid component is introduced within said mixing vessel; and

wherein a gap is provided between the vessel bottom and the second end of said tubular rod for percolating an air/liquid mixture upwardly through the holes in the agitator disc to cause the liquid component to mix with the powder component.

42. The apparatus of Claim 41, wherein said means for introducing said liquid component into said vessel comprises a container having an interior for containing said

liquid component, an end of said container being insertable into said first end of said tubular rod.

43-44. (Cancelled)

45. A method for mixing a liquid and a powder bone cement component in a mixing vessel that is maintained under vacuum for the preparation of bone cement, the method comprising:

providing a mixing vessel defined by a cylinder having an open interior with a spout attached to one end of said cylinder and having an axially displaceable bottom;

providing a mixing agitator and inserting it within said spout so as to communicate with said vessel interior, said agitator comprised of a tubular rod having an apertured agitator disk fixed on one end thereof, an opposite end of said tubular rod being open and defining a mouth, said mouth being located axially above said spout of said vessel;

providing a tightening means in said tubular rod so as to seal said vessel from said atmosphere;

removing said tightening means and thereafter introducing said liquid component into said interior of said vessel;

re-inserting said sealing means within said tubular rod, thereby sealing said vessel from atmosphere;

axially displacing said agitator so as to mix said liquid and powder components under vacuum.

Please add new claims 46-49 as follows.

46. An apparatus for mixing liquid and powder bone components for preparation of bone cement, comprising:

a mixing vessel having an interior space defined by an outer wall having one end with a sealable opening, and an opposite end with an axially displaceable wall;

a vacuum source connected to the interior space of said mixing vessel for maintaining the interior space under vacuum;

an agitator for mixing the liquid and powder bone cement components within the interior space of said mixing vessel, said agitator including an agitator disk disposed within the interior space and a tubular rod connected to said agitator disk and having an open end thereof extending through said sealable opening to the exterior of said mixing vessel, said agitator disk and said tubular rod are axially displaceable relative to said mixing vessel; and

a feed arrangement for feeding the liquid or powder bone cement component into the interior space of said mixing vessel, said feed arrangement includes a container that contains the liquid or powder bone cement component within an interior thereof, and said container includes an open end that is engageable with said open end of said tubular rod for feeding the liquid or powder bone cement component through the tubular rod into the interior space of said mixing vessel, and said container includes an aperture that places the interior of said container in communication with atmosphere.

47. The apparatus according to claim 46, wherein the interior of said container contains an ampoule holding the liquid bone cement component.

48. The apparatus according to claim 47, further comprising a cap secured to an end of said container opposite said open end thereof, said cap is engageable with said ampoule and is displaceable relative to said container for breaking said ampoule to release the liquid bone cement component.

49. The apparatus according to claim 48, wherein said aperture is provided in said cap.